PROCESS AND DEVICE FOR STABILISING A VEHICLE DEPENDING ON THE SPEED OF THE VEHICLE

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Abstract of **WO 9967114 (A1)**

A process is disclosed for stabilising a vehicle, in particular to prevent a vehicle from toppling over about a longitudinal axis and/or from sliding laterally. For that purpose, the vehicle speed and at least two vehicle speed limit values are determined. One of the limit values is selected as a comparative value, in particular the lower one. A comparison based on the speed value and the comparative value is carried out and vehicle stabilising measures are applied depending on the result of the comparison. Should the speed value be higher than the comparative value, the vehicle speed is reduced at least by retarding measures, engine deceleration and/or braking at least one wheel to such an extent that the speed value obtained by these measures is lower than the comparative value.

Result Page

METHOD AND DEVICE TO THE STABILIZATION OF A VEHICLE IN RESPONSE OF THE VEHICLE-SPEED-LARGE
State of the art
The invention relates to a method and a device to the stabilization of a vehicle. Such methods and Devices are from the state of the art in various Modifications known.

From the DE 44 16 991 aluminium is a method and/or. one a-smell tung for warning the drivers of trucks before tilting danger with driving along curves known. For this becomes before the retraction of the Vehicle into a curve the motor vehicle type and for Kippge drive relevant status datas, like vehicle weight and drive things speed of detected. In response of the vehicle emphasis and the turning radius the tilting risk becomes and/or. the critical speed determined relevant for letzeres.

It becomes the speed decrease a requesting Signal triggered, if the current running speed Tilting risk justified or a pre-determined Sicherheitsab stood to the tilting danger is fallen below. For this a pre-determined safety margin of the permissible Fahrge is schwindigkeit opposite the running speed predetermined located at the boundary of the tilting danger.

Adverse one to in the DE 44 16 991 A1 described subject matter is that becomes generated with tilting danger only the driver warning signal, instead of automatic and/or. to accomplish driver-independent measures for the reduction of the vehicle speed and thus for the prevention of the tilting risk. By this proceeding perhaps any longer responsive cannot become punctual on a threatening tilting risk.

From the DE 32 22 149 C2 a device for the avoidance of the since waiting skipping of a vehicle is known. For this the emphasis-high becomes a static stability determined in response of the lane and. From this two permissible boundaries become determined by multiplication with two different safety factors. On the basis of the running speed of the vehicle, the Kurvenradiuses and gravitation acceleration a dynamic instability becomes determined. This dynamic instability becomes compared in two comparisons with in each case one of the two permissible boundaries. If the dynamic instability is larger as the first permissible boundary, then the transmission clutch becomes dissolved.

If the dynamic instability is larger as the second permissible boundary, then the brakes of the vehicle become operated.

The loosening of the transmission clutch as the first measure for the reduction of the vehicle speed represents a critical engagement, there it for example with travels on pleasure straining by it not to a reduction of the speed, but comes inevitably to an increase of the speed. This danger might not exist 32 22 149 C2 with in the DE described vehicle, a gantry lifting truck, since such becomes a gantry lifting truck for ordinary on a planar area inserted.

An object of the instant invention consists of it, existing devices and/or. To improve method to stabilization vehicle going by that for the case, with which a speed-large is larger as a corresponding comparison value not only a warning of the driver made, but that performed in such a case engagements become the stabilization of the vehicle. In particular only such engagements are to become performed, which do not lead in arbitrary driving conditions to the increase of the risk for the vehicle.

An other object consists of seizing various critical situations for the vehicle with the help of a respective limit value for the vehicle speed and/or. to observe and select that critical situation, to accomplish which is most critical in the respective driving conditions, and which stabilization of the vehicle with view on this critical situation.

These objects become by the features of the claim 1 and 10 dissolved by those of the claim.

It concerns advantages of the invention with the invention process a method to the stabilization of a vehicle. In particular tilting of the vehicle is to become around vehicle axle oriented in longitudinal direction of the vehicle and/or chutes of the vehicle in transverse direction avoided. To the illustration is mentioned: If an high lateral acceleration affects at an high friction value a vehicle, then the danger of tilting exists. Against it if a low friction value is present, then the danger of slipping in transverse direction exists.

In this place is noted, as the formulation is to be understood " a vehicle axle " oriented in longitudinal direction of the vehicle: To the one it knows with the vehicle axle, around which a tilting tendency of the vehicle arises, around which actual vehicle longitudinal axis acts. On the other hand it can concern a vehicle axle, which is twisted around a certain angle opposite the actual vehicle longitudinal axis. Thereby it is insignificant whether the twisted vehicle axle goes through the center of gravity of the vehicle or not. The case of the twisted vehicle axle is to permit also such an orientation of the vehicle axle, with which the vehicle axle corresponds either to a diagonal axle of the vehicle or one to this parallel axe. Furthermore is noted that the formulation " chutes of the vehicle in transverse direction " is to also cover spinners of the vehicle.

Favourable-proves a speed comparison is appropriate for the invention process at the basis. For this a speed-large, which describes the vehicle speed, becomes determined. In addition at least two limit values for the vehicle speed become determined. From these two limit values becomes as comparison value a selected. In particular selected becomes as comparison value of the limit values with the smaller value. In response the speed-large and the comparison value the comparison will become of performed and in response this comparison engagements the stabilization of the vehicle performed. For the case, with which the current speed-large is larger as the comparison value, the vehicle speed becomes at least by Retardereingriffe and/or so far reduced by engine interferences and/or by brake interferences at at least a wheel that the speed-large resultant due to the engagements as those or the same comparison value is smaller. Preferably for this the engagements in response of the distance become the speed-large of

the comparison value performed.

Thus at least two various critical situations can become detected and/or observed. Selected thus that one of the limit values becomes as comparison value, ensured that the stabilization of the vehicle for the situation becomes performed, becomes with which the larger danger for the vehicle goes out.

Favourable way two limit values determined become. A first limit value corresponds the tilting danger of the vehicle to a descriptive magnitude. A second limit value corresponds the slip hazard of the vehicle, in particular the slip hazard in transverse direction, to descriptive magnitude. Therefore the tilting danger of the vehicle becomes and with the help of second the slip hazard of the vehicle and/or with the help of the first limit value. the centrifuge danger of the vehicle detected and/or observed.

Favourable way becomes a mass-large determined, which describes the mass of the vehicle. This mass-large becomes at least in response of a magnitude, those the driving force acting on the vehicle describes and in response of the wheel speeds descriptive magnitudes determined. At least a limit value for the vehicle speed becomes this mass-large determined in response. Since the forces applied on the vehicle depend the centrifugal force with a driving along curves, for example, on the vehicle mass, the mass-large direct is received in determination of the limit value.

Since the second limit value corresponds the slip hazard of the vehicle to a descriptive magnitude, the related determination is at least a friction-large, which describes friction conditions between tyres and roadway, present in the respective driving conditions, required. It proved from advantage to determine two friction-large.

First describes the current present friction value, and second the difference of the friction value on the left and/or. the right vehicle side. Thus different friction values become detected due to a corresponding different roadway condition.

With the present invention process favourable-proves a torsion-large becomes determined and/or. a torsion-large is predetermined. This torsion-large characterized, as the vehicle in response behaves on a force applied on the vehicle around a vehicle axle oriented in longitudinal direction of the vehicle. With this force applied on the vehicle it concerns in particular a lateral force. The torsion-large characterized in particular, in which measures distort the vehicle around managing listed vehicle axle due to the force twisted applied on the vehicle and/or and/or one expenditure-steers. For example also a Wankbewegung of the vehicle should be detected by the torsion-large. Since the torsion-large describes the behavior of the vehicle around a vehicle axle oriented in longitudinal direction of the vehicle, she describes thus also the misalignment of the emphasis of the vehicle around this axle. The misalignment of the emphasis the affected behavior of the vehicle with view on an eventual present tilting danger and/or. Slip hazard. Thus the torsion-large of the vehicle can become a more exact and thus better stabilization of the vehicle performed with knowledge. For this purpose the limit values for the vehicle speed in response of the value become the torsion-large determined. The torsion-large again becomes at least the mass-large in response, which describes the mass of the vehicle, determined.

The distance of the vehicle emphasis of the roadway the affected vehicle behavior with view on a tilting risk and/or. on a slide risk of the vehicle in decisive mass. Like that for example the tilting danger of a vehicle is with driving along curves around so large, the per high vehicle emphasis is. From this reason a first high-large becomes determined with the invention process, which describes this distance. This first high-large becomes at least in response of wheel speeds descriptive magnitudes determined.

At least a limit value for the vehicle speed becomes this first high-large determined in response.

The just as affected distance in longitudinal direction of the vehicle oriented of a vehicle axle, over those the vehicle, in response on a force, in particular in response on a lateral force, twisted, applied on the vehicle, and/or distort and/or one expenditure-steers, by the roadway, the tilting risk and/or. the slide risk of the vehicle.

Like that for example the tilting danger of the vehicle is around so large, ever high this axle in the vehicle lies. In order to consider this influence, a second high-large becomes determined, which describes the distance that managing described axle of the roadway. This second high-large becomes at least the mass-large in response, which describes the mass of the vehicle, determined. At least a limit value for the vehicle speed becomes this second high-large determined in response.

Furthermore the tilting risk becomes and/or. the slide risk of the vehicle by the displacement of the charge in particular with driving along curves affected, transported with the vehicle. From this reason, in particular for vehicles with movable, preferably liquid charge, a charge transfer-large determined becomes or is corresponding unit deformation-large predetermined. This charge transfer-large characterized, like the charge of the vehicle in response on a force, in particular in response on a lateral force, applied on the vehicle, behaves, in particular into which mass the charge of the vehicle due to a force displaced applied on the vehicle and/or is expenditure-steered. In order to consider the charge transfer, the limit values for the vehicle speed become at least this charge transfer-large determined in response of the value.

The charge transfer-large becomes at least determined in response of a mass-large, which describes the mass of the vehicle. For example this becomes mass-large the volume of the charge determined, and the charge transfer-large in response of this volume determined with movable, preferably liquid charge, in response. Complementary one becomes those the charge transfer-large descriptive magnitude in response of a magnitude, those the device characterized, determined present at the vehicle to the receptacle of the charge. In particular the value of the magnitude, the device characterized, depends those at least on the form this device present at the vehicle to the receptacle of the charge. With vehicles, the one liquid charge to transport can favourable-proves during Beladebzw. Discharge process of the device the receptacle of the charge the volume of the liquid charge direct determined become. In response of this volume then the charge transfer-large becomes determined.

Beside the described magnitudes also a Bahngrö is sse, which describes the radius of the current web, in particular the current curve durchfahrenen of the vehicle, driven by the vehicle, concerning. the tilting risk and/or. the slide risk of importance. The ever small turning radius with same permanent vehicle speed is, the larger is the lateral forces acting on the vehicle, the larger is the tilting danger and/or. the slip hazard. From this reason the limit values for the vehicle speed in response become this course-large determined. The course-large again becomes the speed-large in response and a guidanceanglelarge, which describes the steering angle of the vehicle, determined.

The invention process has the advantage that is required on the basis of the sensor technology, which is in a system to the control the driving dynamics of the vehicle of a descriptive magnitude present no additional sensor technology.

Such a system to the control the driving dynamics of the vehicle of a descriptive magnitude is for passenger cars for example in in the automobile-technical magazine (CORRODE) the 96.1994, booklet 11, on the sides 674 to 689 appeared publication " FDR The driving dynamics regulation of Bosch " or for commercial vehicles in the SAE PAPER 973284 “Vehicle dynamics control for commercial vehicles " described.

The evaluation of the steering angle as input with the invention process has the subsequent advantages: By the steering angle predetermined of the driver a driving along curves becomes initiated. Therefore D can by evaluation of the steering angle already in the apron. h. before the actual danger situation arises, found become whether for the vehicle a tilting risk or a slide risk exists. D. h., should be present such a risk, then stabilizing engagements very rapid can take place and thus in time. With other words, the

evaluation of the steering angle corresponds to the realization of a so called Preview function. Furthermore stabilizing engagements become only performed with driving along curves, D. h. with a travelling straight ahead as disturbing emp fundene stabilizing engagements are prevented from the beginning.

Other advantages as well as advantageous embodiments can become the Unteransprüchen, whereby also arbitrary combinations of the Unteransprüche are more conceivable, the drawing as well as the description of the embodiment removed.

Drawing the drawing consists of the figs 1 to 5. The figs Ia and Ib show an integral and/or. a two-piece vehicle, becomes inserted with which the invention process. The figs 2a to 2d provide commercial vehicles for different motor vehicle types, to the transportation of more liquid and/or. not liquid charge as well as passenger car, those the invention process and/or. the device according to invention underlying problem. In the figs 3 and/or. 4 the device according to invention becomes the execution of the invention process shown in different Detailiertheitsgrad in an overview arrangement.

Fig 5 points an embodiment with the help of a flow chart to the execution of the invention process.

It is pointed out that blocks with the same designation in different figs have the same function.

Embodiment first is to be dealt with the figs Ia and Ib, some integral and/or. a two-piece road vehicle represent, with which the invention process can come to the use.

In fig Ia an integral vehicle is 101 shown.

With this vehicle it can concern both around persons a motor vehicle and a commercial motor vehicle. This vehicle is to exhibit at least two wheel axles, what by the partial broken illustration indicated is. The wheel axles of the vehicle 101 are referred with 103ix. Whereby in this place for the wheel axles, in place of which in fig Ia used detailed way of writing becomes, a shortening way of writing used, for which the Index indicates i whether it concerns a front axle (v) or around a rear axle (h). By the Index x indicated becomes with vehicles with more than two axles, around which Vorderbzw. Rear axles it acts. The subsequent association applies: The front axle and/or. the rear axle, which is next the vehicle bound, the Index is x with the smallest value associated in each case is. The further the respective wheel axle of the vehicle bound is remote, the grö more sser the value of the associated Index is x. The wheel axles 103ix are the wheels 102ixj associated. With the Index j displayed becomes whether itself the wheel on the right (r) and/or. on the left (1) vehicle side finds. Furthermore the vehicle 101 contains a controller 104, in which erfindungsgemä the SE device is implemented for the execution of the invention process.

In fig Ib a vehicle combination is, existing from a tractor 105 and a semitrailer 106 shown. The selected illustration is not to represent limitation, more conceivable is also a vehicle combination, which consists of a tractor and a pole trailer. The tractor 105 is to exhibit the wheel axles 108iz. The wheel axles 108iz are wheels 107ijz associated. The Index z indicates that it itself around wheel axles and/or. Wheels of the tractor acts.

Furthermore the tractor 105 exhibits a controller 109, in which the invention process runs off and with both the tractor 105 and the semitrailer 106 stabilized becomes. The semitrailer 106 is to contain two wheel axles 108ixa. The two wheel axles 108ixa are in corresponding manner the wheels 107ixja assigned. The Index A indicates that it concerns components of the semitrailer 106. The number of wheel axles for the tractor 105, represented in fig Ib, and/or. for the semitrailer no limitation is to represent 106. The controller 109 can be in place of in the tractor 105 also in the semitrailer 106 arranged. Furthermore it is more conceivable to equip both the towing vehicle 105 and the semitrailer 106 with in each case a controller.

In the figs Ia and Ib selected identification by the Indexes the A, i, j, x as well as z is for all magnitudes and/or.

Components, with which she finds use, corresponding.

Subsequent one is to be dealt with the figs 2a to 2d. With the help of these figs are physical circumstances, that the invention process and/or. the device according to invention, shown is the basis and/or. discussed become.

Fig 2a points a vehicle to the transportation movable, in particular liquid charge. As example is for this a tank truck and/or. a tanker mentioned. In the sectional view the wheels are 201 and/or. to see 202, stand exemplarily with an axle the 207 in connection. Over suspension devices 203 and/or. 204 is a vehicle bodywork 205a, in which the charge which can be carried is, with the axle 207 connected. The vehicle represented in fig 2a is to be in a to the left directed driving along curves. With R the lane of the vehicle is referred.

With the vehicle represented in fig 2a both the influence of the torsion, which becomes described by torsion-large C, and the influence of the charge transfer, which becomes described by the charge transfer-large K, are shown.

The magnitude h indicates the distance of the emphasis of the vehicle of the roadway. The gravity attacking at the vehicle in the respective center of gravity is by the magnitude mg characterized. The magnitude HC indicates the distance in longitudinal direction of the vehicle oriented of a vehicle axle 206a, over those the vehicle, in response on a force twisted applied on the vehicle and/or distorts and/or is expenditure-steered, by the roadway. The magnitude hsc, which indicates the distance between the center of gravity of the vehicle and that managing to described vehicle axle 206a, can become for example from the magnitude h and the magnitude HC by subtraction certain. With C the torsion-large is referred, which describes the behavior of the vehicle around those managing described vehicle axle 206a in response on a force applied on the vehicle, in particular a lateral force. This force is in fig 2a as force F shown. It is to concern here the centrifugal force arising due to driving along curves. The wheels of the vehicle the forces flat steel bar affect and/or. FR.

With SP1 the center of gravity of the vehicle is, as it for example with a travelling straight ahead would be present, shown. With delta the torsion-conditional vertical displacement of the emphasis from SP1 is shown to SP2, which results due to driving along curves. The vehicle is expenditure-steered related to the axle 206a around the angle alpha. The torsion-conditional displacement and/or. Deflection is the charge transfer-conditional superimposed. The charge transfer-conditional displacement is with deltaf and the associated deflection with alphaf referred. This an effected displacement of the emphasis from SP2 to SP3.

Altogether thus a displacement results and/or. Auslen kung of deltat and/or. alphat and thus a displacement of the emphasis from SP1 to SP3. In addition become by the torsion-conditional and/or. charge transfer-conditional displacement and/or. Deflection the forces flat steel bar and/or. FR going by changes the fact that the corresponding forces decrease in the circle-inner wheels and in the circle-outside wheels increases the forces.

On the basis the illustration in fig one sees 2a that with commercial vehicles particularly because of the high-located and variable position of the center of gravity to the spatial behavior of the vehicle must be paid attention. Motor vehicles, which transport liquid load, are particularly endangered. Beside the torsion-conditional influences are also the influences, which result due to a liquid misalignment to the circle-outside side of the vehicle to consider. That managing listed ones applies in corresponding manner also to passenger cars. In this connection is already to still referred to descriptive fig the 2d in this place.

In this place is noted that previously mentioned torsion-large C is to cover all torsion-conditional influences applied on the vehicle,

D. h. the entire torsional rigidity of the vehicle, for example from the single torsional rigidities for the frame, describes itself torsion-large C which builds tyres as well as the suspension devices up.

In fig 2b a vehicle, in particular a commercial vehicle, is shown, which becomes used for ordinary charge not-movable to the transportation. Without the illustration of the suspension devices more half one did to the clarity. Since in the illustrated case from a charge transfer is not to be proceeded, and/or. this in reread victoryable mass arises, becomes the center of gravity only torsion-conditional from SP1 to SP2 displaced and/or. expenditure-steered.

However a change of the position of the center of gravity steps and thus at least a change of the magnitudes hsc and/or due to different strong loading of the vehicle. h.

The corresponding illustration in fig 2b is in fig 2d same circumstances for a passenger car shown. With a passenger car is mainly a torsion-conditional displacement and/or. To expect deflection of the emphasis. A charge transfer-conditional might arise in rare cases, for example with so called Pickup Trucks or similar small transportation motor vehicle.

Fig 2C shows a vehicle, which neither a torsion-conditional still another charge transfer-conditional displacement and/or. Deflection of the emphasis to exhibit is.

With the illustration of the various vehicles in the figs 2a to 2d brought is to become the term that the invention process for arbitrary vehicles is more applicable. Like that the invention process is with vehicles applicable, with those it to a torsion-conditional and/or. charge transfer-conditional deflection and/or. Displacement of the emphasis comes. Likewise the invention process for vehicles applicable, with those is it only to a torsion-conditional displacement and/or. Deflection of the emphasis comes. Furthermore the invention process for vehicles applicable, with those is neither a torsion-conditional still another charge transfer-conditional deflection and/or. Displacement of the emphasis arises. The invention process is more insertable for example also for buses.

Subsequent one is to be dealt with fig 3.

Fig 3 is the basis an integral vehicle, as it is for example in fig Ia shown. From this reason the controller 104 is contained in fig 3. This illustration is not to work however restrictive, since the subject matter of the invention is more applicable in corresponding manner also for a vehicle, how it is in fig Ib shown.

For this 3 eventual corresponding modifications are required on the basis of fig.

It is assumed that the integral vehicle at least two wheel axles, a front axle 103vl with the wheels 102vlr and/or. 102vll as well as a rear axle 103hl and the wheels 102hlr and/or. 102hll exhibits. Too these wheels belonging wheel number of revolutions sensors 302ilj are in fig 3 shown. Depending upon number of the wheel axles of the integral vehicle, as into fig 3 indicated, other wheel number of revolutions sensors 302ixj are added. With the wheel number of revolutions sensors 302ixj become Grö ssen nixj determined, which describe the wheel speed of the corresponding wheel 102ixj in each case. The magnitudes nixj become blocks 306.308.309 as well as 310 supplied. The wheel number of revolutions sensors 302ixj are independent of the type of the controller 310 in any case present.

Furthermore the vehicle contains a sensor 303, determined with which a guidanceanglelarge becomes deltal, which describes the steering angle of the vehicle. This sensor 303 is likewise independent of the type of the controller 310 in any case present. The guidanceanglelarge deltal becomes a block 307, a block 309 as well as the block 310 supplied.

The block 310 places in the controller 104 implemented controllers and/or. Vehicle automatic controller. With this controller 310 it concerns in general manner a Schlupfregler.

This Schlupfregler can for example as if brake schlupfregler and/or as drive slip automatic controller designed to be. In the present embodiment it is itself around a Schlupfregler and/or. Controller act, which regulates the driving dynamics of the vehicle in its basic function a descriptive magnitude, for example a magnitude dependent of the lateral acceleration and/or the greed rate of the vehicle, at least by engagements into the wheel brake and/or into the motor. In this place " FDR The is driving dynamics regulation of Bosch " and/or on the previously mentioned publication. to the SAE PAPER referred 973284, in which a system is to the control the driving dynamics of the vehicle of a descriptive magnitude described.

With the block 310 late still detailed is dealt.

The block 310 becomes already in this place with view on the still descriptive sensor technology mentioned. Since it is to concern with the block 310, like mentioned already above, a controller to the control the driving dynamics of the vehicle of a descriptive magnitude, other sensors are required to the realization of this control. Depending on, which for a brake system the vehicle has, a sensor is 301 required, becomes detected with which a pressure-large Pvor, which describes the form set of the driver. By the paint-lined illustration is not indicated to become that the sensor is 301 required with an hydraulic brake system, on the other hand with a pneumatic brake system required is. Likewise a sensor 304 is required to the detection of the greed rate omega of the vehicle as well as a sensor 305 to the detection of the lateral acceleration acting on the vehicle aq. The 305 magnitudes detected with the sensors 301.304 as well as become the block 310 supplied. In this place are again mentioned that the sensors

In the block 306 the speed of the vehicle becomes a descriptive magnitude vf determined, those the blocks 307 and/or in known manner from the wheel speeds nixj. 309 supplied becomes. In the block 307 the guidanceanglelarge becomes deltal a course-large r, which describes the radius of the current web, in particular the current curve driven by the vehicle, driven by the vehicle, determined on the basis of the vehicle speed vf and. The magnitude r becomes for example using the equation
EMI18.1
determined. In equation (1) the magnitude IL stands for the entire guidance translation, the magnitude vch represents a characteristic speed for the vehicle and the magnitude 1 represents the wheel base. The magnitude r becomes the block 310 supplied.

Beside the already mentioned magnitudes nixj the block 308 on the basis of the block 310 a magnitude Fantr supplied becomes. This magnitude describes the driving force acting on the vehicle. It becomes in the block 310 in known manner at least in response of the engine behavior descriptive magnitudes determined, as example is here the engine speed listed. In the block 308 a mass-large M, which describes the mass of the vehicle, becomes determined on the basis of it the supplied magnitudes. This mass-large becomes the block 309 supplied.

In the block 309 determined becomes on the basis of a speed comparison whether a reduction of the vehicle speed is required, so that the vehicle does not tilt around a vehicle axle oriented in longitudinal direction of the vehicle over and/or that the vehicle does not slip in transverse direction. The execution of this speed comparison the block 309 the already mentioned magnitudes M, nixj, become vf, r as well as deltal supplied. In addition the block 309 on the basis of the block 310 two friction-large become y and/or. delta as well as magnitudes mlix supplied. The two magnitudes y and/or. delta represent friction-large, which describe friction conditions between tyres and roadway, present in the respective vehicle situation. The magnitude y describes the current present

friction value. Them become in the block 310 for example in response of the longitudinal acceleration and the lateral acceleration estimated. The magnitude delta describes the difference of the friction value on the left and/or. the right vehicle side. During a braking operation the magnitude becomes deltay in the block 310 for example in response of the wheel brake cylinder pressures as well as the wheel speeds determined. In this connection is to the DE 35 35 843 A1 referred.

Alternative one can become the magnitude delta in the block 310 also in response of the engine moment and the wheel speeds determined. For this is for example to the DE 37 35 673 aluminium referred.

The magnitudes mlix represent the oh-based wheel loads. They become in the block 310 in known manner for example from the wheel speeds determined.

The result of the speed comparison becomes outputted with the help of the magnitude vred. The for example subsequent association is to apply: If a reduction of the vehicle speed is required, then the magnitude vred the value is TRUE assigned. Is required against it if no reduction of the vehicle speed, then the magnitude vred the value is FALSE assigned. The magnitude vred becomes the block 310 supplied. On the execution of the speed comparison becomes in connection with the figs 4 and/or. 5 detailed received.

Like mentioned already above, the block 310 represents the vehicle automatic controller implemented in the controller. With this vehicle automatic controller it acts for example around a controller to the control the driving dynamics of the vehicle of a descriptive magnitude, like it in the previously mentioned publication " FDR The driving dynamics regulation of Bosch " and/or. the SAE PAPER 973284 described is. This control that the driving dynamics of the vehicle descriptive magnitude leads the controller 310 in its basic function in response with the help of the sensor of the 301 (if present) as well as the sensors 302ixj, 303.304 and/or. 305 detected magnitudes, as well as the magnitude mot2, which describes for example the engine speed or the engine moment of the motor 311, through.

On the basis of that managing listed magnitudes the determined controller 310 at least for the motor 311 and/or. the actuators 313ixj of drive signals to the realization of the slip control implemented in the controller 310 as basic function. The drive of the motor 311 a magnitude becomes motl determined and the motor supplied in the block 310. This magnitude motl represented for example the butterfly valve position which can be stopped. For the actuators 313ixj, which are for example formed as wheel brakes, 310 magnitudes Aixj determined and the corresponding actuator supplied become in the block. The magnitudes Aixj represent for example the drive signals for those to the wheel brakes of associated valves. Complementary one can be to the actuators 313ixj a Retarder 312 provided.

The drive of the Retarders a magnitude Ret determined and the Retarder supplied becomes in the block 310.

In this place is mentioned that it can concern with the brake system an hydraulic or an electrohydraulic or a pneumatic or an electro-pneumatic or an electromechanical.

Additional one to the control implemented in the controller 310 in the basic function has the controller 310 the object to stabilize the vehicle in such a way that tilting the vehicle around a vehicle axle oriented in longitudinal direction of the vehicle and/or. chutes of the vehicle in transverse direction avoided becomes. In the frame of this stabilization the satisfied controller two objects: The one become if the magnitude vred the value TRUE assigned is, corresponding drive signals for the motor 311, the actuators 313ixj, the Retarder of 312 and from the state of the art known means 314 the interference landing gear the generated, so that mentioned tilting and/or. Chutes avoided becomes. To the drive of the means 314 the generated controller 310 a magnitude FW1.

Simultaneous one becomes the controller 310 on the basis of the means 314 a FW2 supplied, which describes the current adjustments of the landing gear and in the controller 310 required as feedback for the control is. The drive to the avoidance of tilting and/or. slipping can the drive taking place in accordance with the basic function superimposed be.

Or the drive in accordance with the basic function is faded out for the time, in the one drive to the avoidance of tilting and/or. slipping performed becomes. On the other hand 310 those become already managing listed magnitudes, deltay, mlix as well as Fantr determined and the corresponding blocks supplied in the controller.

Subsequent one becomes fig 4 treated, shown in which the block is 309 in a larger detailed.

In a block 401 the charge transfer-large K determined on the basis of the mass-large M, which become both a block 404 and a block 405 supplied, become. Which it averaging the charge transfer-large K runs off for example as follows: In the apron becomes for a vehicle or a vehicle combination, existing from a tractor and a trailer or semitrailer, for a known charge and/or. for a liquid with known density by driving attempts the magnitude K in response of the vehicle mass M certain. From the pair of the magnitudes K and/or. M becomes a family of characteristics generated, which in the block 401 deposited is.

Thus that can become the block 401 supplied magnitude M a value for the magnitude K determined in response of the value.

The determination of the magnitude K alone in response of the vehicle mass is suitable if the tractor with a known semitrailer or trailer operated becomes, and if the density of the liquid charge known is.

The determination of the magnitude K can be improved going by that the magnitude K for any vehicle combination and any charge, D. h. for a liquid of arbitrary density certain will can. This has the subsequent background: To the one the magnitude K hangs into strong measures of the respective trailer and/or. Semitrailer off, since in response of the form of the device, which is present to the receptacle of the charge, a different misalignment ability of the liquid and thus the emphasis results. On the other hand the magnitude K strong depends on how the large volume of the charge is, which can shift during the travel.

For example a tanker with a tank filled to 20% exhibits a stronger misalignment of the emphasis than a tanker with a tank filled to 70%. Therefore particularly with liquid charge a large importance comes to the density of the charge, since it contributes the volume of the charge and thus the able to be shiftedness of the emphasis with predetermined mass to strong mass. Therefore provided can be, in the block 401 in response of the used semitrailer and/or. To put down trailer and into response of the volume of the charge of various family of characteristics. To the determination of the magnitude K would be then however in the controller Auflieger-bzw. Anhängererkennnung required, and/or. the controller in suitable way the density of the charge would have to become reported. In response of the recognized trailer and/or. Semitrailer and in response of the determined charge volume then the magnitude K determined can become in the block 401. The charge volume becomes determined with known mass of the empty vehicle from the vehicle mass and the density of the charge. Alternative one knows the volume of the liquid charge also during Belade-bzw. Discharge process of the device the receptacle of the charge direct determined become. This is therefore possible, since for example tankers exhibit display devices, those the volume of the supplied and/or. discharged liquid charge indicate.

To the determination of the current volume value is only the supplied volume and/or. to add the discharged volume to the last volume value, which favourable-proves deposited in the controller is, and/or. to subtract from this to.

To the problem of the charge transfer Duesseldorf, 1970, is resuming in the magazine " German force travel research and road traffic engineering ", booklet 200, published research report " the tilting border of semitrailer trucks with fixed and liquid charge "

from H in this place on in the VDI publishing house. Isermann referred.

Alternative one can be with liquid charge unknown density provided that becomes assumed for this liquid a reference-dense, and the determination of the magnitude K with the help of this reference-dense performed becomes. It is to be noted however that the reference-dense becomes a so selected that an eventual threatening tilting danger and/or. Slip hazard still realistic appreciated will can.

In a block 402 determined in response of the magnitude M torsion-large C, which become both a block 404 and a block 405 supplied, becomes. The determination of torsion-large C runs off corresponding that the charge transfer-large K. In the apron the magnitude becomes C in response of the vehicle mass M certain for a vehicle or a vehicle combination by driving attempts. From the pair of the magnitudes C and/or. M becomes a family of characteristics generated, which in the block 402 deposited is. Thus that can become the block 402 supplied magnitude M a value for the magnitude C determined in response of the value. The determination of the family of characteristics in the Vorfels can become by simulation computations supported. An improvement of the determination of the magnitude C with view on arbitrary vehicle combinations can become the corresponding with the charge transfer-large K achieved.

In a block 403 the first high-large h and the second high-large HC determined becomes. The determination of the first high-large runs off for example as follows: First the course-large r becomes dynamic Rollradien, which describe the behavior of the respective wheel, determined in response of the vehicle speed vf, the wheel speeds nixj and. On the basis of these dynamic Rollradien bottom consideration of the oh-based wheel loads mlix, the vehicle speed vf and the course-large r becomes the first high-large h, which corresponds to the emphasis-high, h determined. The determination of the second high-large HC made with the help of a family of characteristics. Also this family of characteristics becomes in the apron for example by driving attempts in response of the magnitude M determined. Using the supplied magnitude M a value for the second high-large determined becomes in the block 403. The two high-large h and/or. HC become both the block 404 and the block 405 supplied.

Furthermore become the blocks 404 bz. 405 still the Bahngrö SE r as well as the mass-large M supplied. The block 404 the additional first friction-large y and the second friction-large delta supplied becomes.

In the block 404 the second limit value becomes vr in response that the block 404 supplied magnitudes determined and the block 406 supplied. General one, D. h. if the torsion-conditional and the charge transfer-conditional influences become considered, this second limit value results vr for example in accordance with the equation
EMI25.1

<September> gRCrCr delta)
<tb> = <September> C-deltap <September> (HC <September> + <September> hsc <September> M <SEPTEMBER> g <September> + <September> K <SEPTEMBER> C <SEPTEMBER> g)
<tb> The equation (2) is to apply for D to the vehicle represented in fig 2a. h. circumstances when driving through a link curve describe. In equation (2) the Grö corresponds to SE g of the gravitation-constant (9.81 m/s2) and the magnitude R corresponds to the gauge. The magnitude yr describes the friction value on the right vehicle side and becomes on the basis of the friction-large y and/or. delta determined. The magnitude hsc describes the distance of the vehicle emphasis of the vehicle axle oriented in longitudinal direction of the vehicle, z. B. 206a in Fig. 2a, over those the vehicle, in response on a force twisted applied on the vehicle and/or distort and/or are expenditure-steered. The magnitude hsc becomes from first and the second high-large determined. To a right curve equation (for 2) applies corresponding, however is to be used in place of pr in this case SI, which likewise on the basis of the friction-large y and/or. delta determined becomes. The detection, whether Links-oder a right curve is present, becomes in response that the block 404 supplied guidanceanglelarge deltal made.

Becomes a vehicle considered, which does not give to transported and it a movable charge thus no charge transfer conditional influences, and/or. with that the charge transfer-conditional influences are more negligible, then the magnitude becomes vr determined in accordance with a simpler equation, which results from the equation (2) for K=0. This is for example for the vehicles of the figs 2b and/or. 2d apply.

Step simultaneous no different friction values on the left and/or. the right vehicle side up, then the equation results to the determination of vr from the equation (2) for K=0 and for deltas=0. If simultaneous no torsion-conditional and no charge transfer-conditional influences are present, and that no different friction values between the left and/or. the right vehicle side are present, become the magnitude vr in accordance with an equation determined, which results from equation (2) for K=0, deltas=0 and C=oo. This is for example for in Fig. 2C represented vehicle apply.

In the block 405 the first limit value becomes vk in response that the block 405 supplied magnitudes determined and the block 406 supplied. General one, D. h. if the torsion-conditional and the charge transfer-conditional influences become considered, this first limit value results vr for example in accordance with the equation
EMI26.1
The equation (3) is to apply to the vehicle represented in fig 2a. Apart from the embodiments concerning. the two friction values apply to equation (3) above the considerations corresponding listed for equation (2).

Those managing listed cases, those on the basis of the equations (2) and/or. (3) to different determination equations for the limit values vr and/or. vk, becomes by the determination that leads the block 309 supplied magnitudes detected. Alternative one can be provided, if for example for a vehicle combination known is that it does not become inserted for the transportation liquid charge, the
top corresponding simplified equation in the blocks 404 and/or. to put down 405.

The block 406 additional becomes the two limit values vr and/or. vk the vehicle speed vf supplied. In response of these magnitudes determined becomes whether is required for the vehicle a stabilization. The result of this determination becomes outputted with the help of the magnitude vred. First becomes in the block 406 from the two limit values vr and/or. vk the limit value with the smaller value than comparison value selected. With this comparison value the vehicle speed becomes vf compared. If the vehicle speed is larger vf as the comparison value, then this points on an unstable state of the vehicle and a stabilization of the vehicle is required. The magnitude vred the value becomes TRUE assigned. Against it if the vehicle speed is smaller as the comparison value, then this points on a stable condition of the vehicle and a stabilization of the vehicle might not be required. Corresponding one becomes the magnitude vred the value FALSE assigned.

In the following fig becomes 5 described, which shows the flow of the invention process with the help of a flow chart. The invention process begins with a step 501, in which the magnitudes C, HC, h, K, become deltay, M, r as well as vf provided. Concerning. the determination of these magnitudes is on the description of the blocks 306.307, 308.310.401.402 and/or. 403 referred. The step 501 a step 502 follows, in that the two limit values vr and/or. vk determined become. For this is on the description of the blocks 404 and/or. 405 referred.

Subsequent to the step 502 a step 503 executed becomes, in which the smaller of the two limit values vr and/or. vk as comparison value vmax determined becomes. In the subsequent step 504 the vehicle speed becomes vf compared with the comparison value vmax. In this place is referred to the description of the block 406. However the magnitude is not vred shown in fig 5. If the vehicle

speed is smaller vf as the comparison value vmax, then subsequent to the step 504 becomes again the step 501 executed. This corresponds to the assignment of the value FALSE to the magnitude vred. Against it if 504 found become in the step that the vehicle speed is larger as the comparison value vmax, then subsequent becomes to the step 504 a step 505 executed. In the step Retardereingriffe and/or engine interference and/or brake interference so performed that the vehicle speed reduced will and thus the vehicle becomes stabilized. Without the illustration of the drive signals for the single managing listed components in fig 5 one did. Subsequent to the step 505 the step 501 executed becomes again.

Final one is to a noted that the form of the embodiment selected in the description as well as the illustration selected in the figs are not to represent limiting effect on the invention-substantial idea. On the other hand some points are again summarized: With the invention process will apart from the centrifuge behavior of the vehicle in the plane also the Wankbewegung of the vehicle around a vehicle axle detected oriented in longitudinal direction of the vehicle becomes. This Wankbewegung can be depending upon loading condition of the vehicle and road surfacing various strong and perhaps lead to tilting the vehicle. The invention process and/or. the device according to invention is so designed that the for this required sensor technology is accommodated with vehicle combinations in the towing vehicle.

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Claims of WO9967114	Print	Copy	Contact Us	Close

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Claims 1. Method to the stabilization of a vehicle, in particular to the avoidance of tilting a vehicle around a vehicle axle oriented in longitudinal direction of the vehicle and/or to the avoidance of slipping the vehicle in transverse direction, with that a speed-large (vf), which the vehicle speed describes, determined, with that at least two limit values (vr, vk) for the vehicle speed determined will become, selected with which one of the limit values becomes as comparison value (vmax), especially becomes as comparison value the limit value with the smaller value selected, with which in response the speed-large and the comparison value become a comparison performed, and performed with which in Abhångigkeit of the comparison engagements (vred) become the stabilization of the vehicle, in particular for the case, with which the speed-large is larger as the comparison value, at least by Retardereingriffe and/or by engine interferences and/or by brake interferences at at least a wheel, the vehicle speed will become so far reduced that the speed-large resultant due to the engagements as those or the same comparison value is smaller, preferably for this the engagements in response of the distance of the speed-large of the comparison value performed.

2. Process according to claim 1, characterised in that of two limit values determined becomes, whereby a first limit value (vk) corresponds the tilting danger of the vehicle to a descriptive large one and/or whereby a second limit value (vr) corresponds the slip hazard of the vehicle, in particular in transverse direction, to descriptive magnitude.

3. Process according to claim 1, characterised in that at least a friction-large (u, deltau) determined will become, which describes friction conditions between tyres and roadway, present in the respective driving conditions, preferably two friction-large, first, which describes the current present friction value, and second, those the difference of the friction value on the left and/or. the right vehicle side describes, determined, and that at least one of the limit values for the vehicle speed in response becomes this at least a friction-large determined.

4. Process according to claim 1, characterised in that a torsion-large (C) determined will or predetermined is, those characterized, like the vehicle in response on a force, in particular in response on a lateral force, applied on the vehicle, around a vehicle axle oriented in longitudinal direction of the vehicle behaves, in particular into which measures the vehicle around this vehicle axle due to a force twisted applied on the vehicle and/or to wound and/or is expenditure-steered, and that the limit values for the vehicle speed in response of the value become this torsion-large determined, especially the torsion-large at least in dependent ones keit a mass-large (m), which describes the measures of the vehicle determined.

top

5. Process according to claim 1, characterised in that a first high-large (h) determined will, which describes the distance of the vehicle emphasis of the roadway, especially becomes this first high-large at least in response of the wheel speeds descriptive magnitudes (nixj) determined, and that at least a limit value becomes this first high-large determined for the vehicle speed in response, and/or that a second high-large (HC) becomes determined, those is expenditure-steered the distance of a vehicle axle, over those the vehicle in response on a force, oriented in longitudinal direction of the vehicle, in particular in response on a lateral force, twisted, applied on the vehicle, and/or to wound and/or, by the roadway describes, especially this becomes second high-large at least in response of a mass-large (m), which describes the measures of the vehicle, determined, and that at least a limit value becomes this second high-large determined for the vehicle speed in response.

6. Process according to claim 1, characterised in that a mass-large (m) determined will, which describes the measures of the vehicle, especially becomes the mass-large at least in response the driving force (Fantr), acting on the vehicle, descriptive magnitude and the wheel speeds descriptive magnitudes (nixj) determined, and that at least a limit value for the vehicle speed in response becomes this mass-large determined.

7. Process according to claim 1 characterised in that, in particular for vehicles with more movable, preferably more liquid, charge, a charge transfer-large (C) determined or predetermined is, those characterized, like the charge of the vehicle in response on a force, in particular in response on a lateral force, applied on the vehicle, verhält themselves, in particular into which measures the charge of the vehicle due to a force displaced applied on the vehicle and/or is expenditure-steered, and that the limit values for the vehicle speed become at least this charge transfer-large determined in response of the value.

8. Process according to claim 7, characterised in that mass-large determined becomes, which mass vehicle describes, and that the charge transfer-large in response becomes this mass-large determined, especially becomes with movable, preferably liquid charge, in response this mass-large volumes charge determined, and charge transfer-large in response this volume determined, and/or that the charge transfer-large in response of a Gro sse, which becomes the device characterized, determined present at the vehicle to the receptacle of the charge depends especially the value of this magnitude at least on the form of the device, and/or that with liquid charge protecting Belade-bzw. Discharge process of the device to the receptacle of the charge the volume of the liquid charge direct determined it becomes and that the charge transfer-large in response of this volume determined becomes.

9. Process according to claim 1, characterised in that the limit values for the vehicle speed in Ahangigkeit of a course-large (r), those the radius of the current web driven by the vehicle, in particular the current of Vehicle durchfahrenen curve, describe, determined become, especially the course-large in response becomes the speed-large (vf) and a guidanceanglelarge (deltal), which the steering angle of the vehicle describes, determined.

10. Device to the stabilization of a vehicle, in particular to the avoidance of tilting a vehicle around oriented a vehicle axle in longitudinal direction of the vehicle and/or to the avoidance of slipping the vehicle in transverse direction, which contains first means (306), with those a speed-large, which the vehicle speed describes, determined, which second means (404,405) contain, with which at least two limit values for the vehicle speed determined will become, which third means (406) contain, with which one of the determined limit values becomes as comparison value selected, especially becomes as comparison value the limit value with the smaller value selected, and with which in response the determined speed-large and the comparison value become a comparison performed, and which fourth means (310,311,312,313ixj, 314) contain, performed with which in response of the accomplished comparison engagements become the stabilization of the vehicle, especially become for the case, with which the speed-large is

larger as the comparison value, at least Retardereingriffe and/or engine interferences and/or at at least a wheel of brake interferences performed, by which the vehicle speed so far reduced will become that the speed-large resultant due to the engagements as the comparison value is smaller, preferably for this the engagements in response of the distance of the speed-large of the comparison value performed.

FIG. 1a

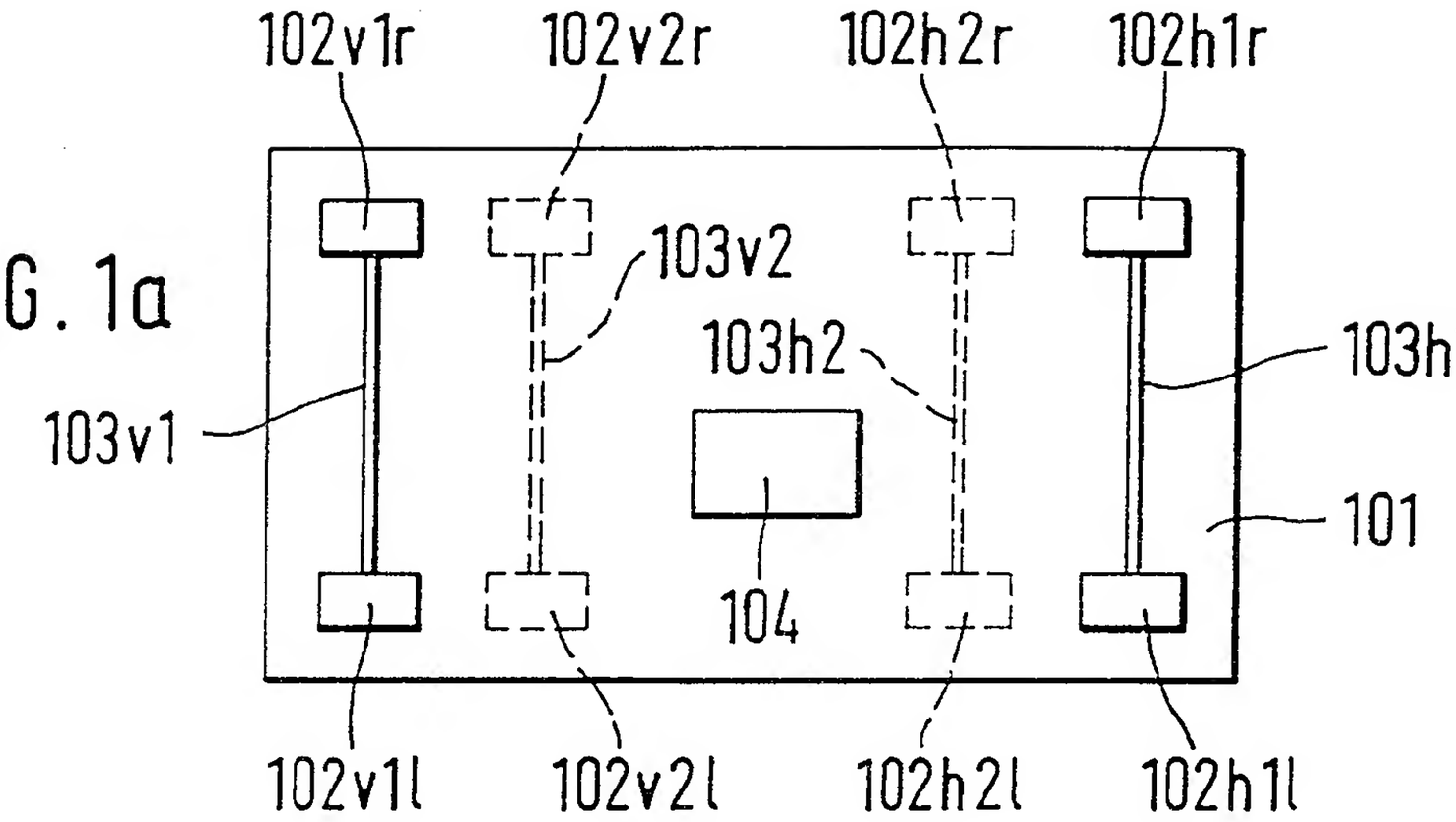
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FIG. 1b

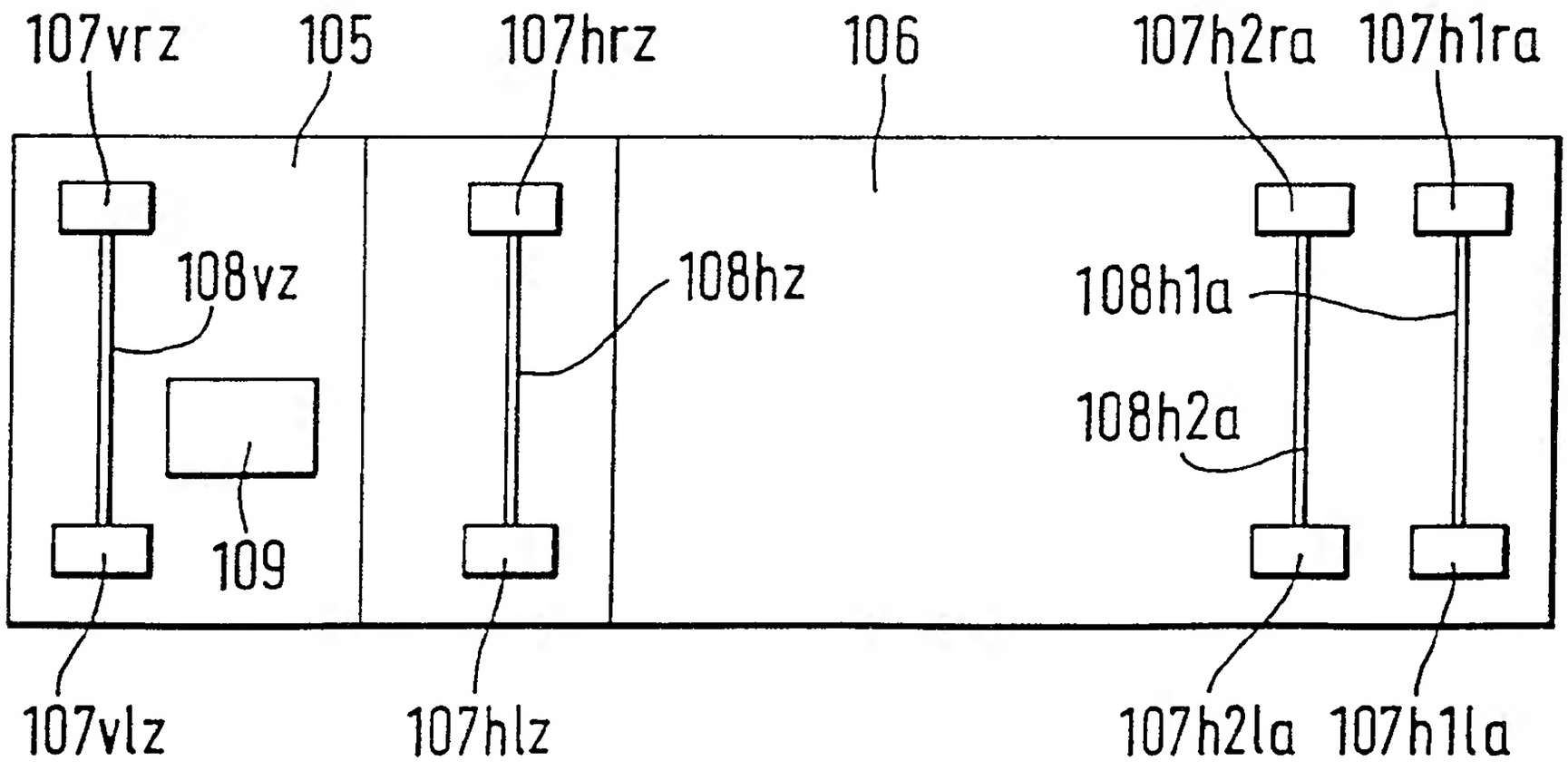
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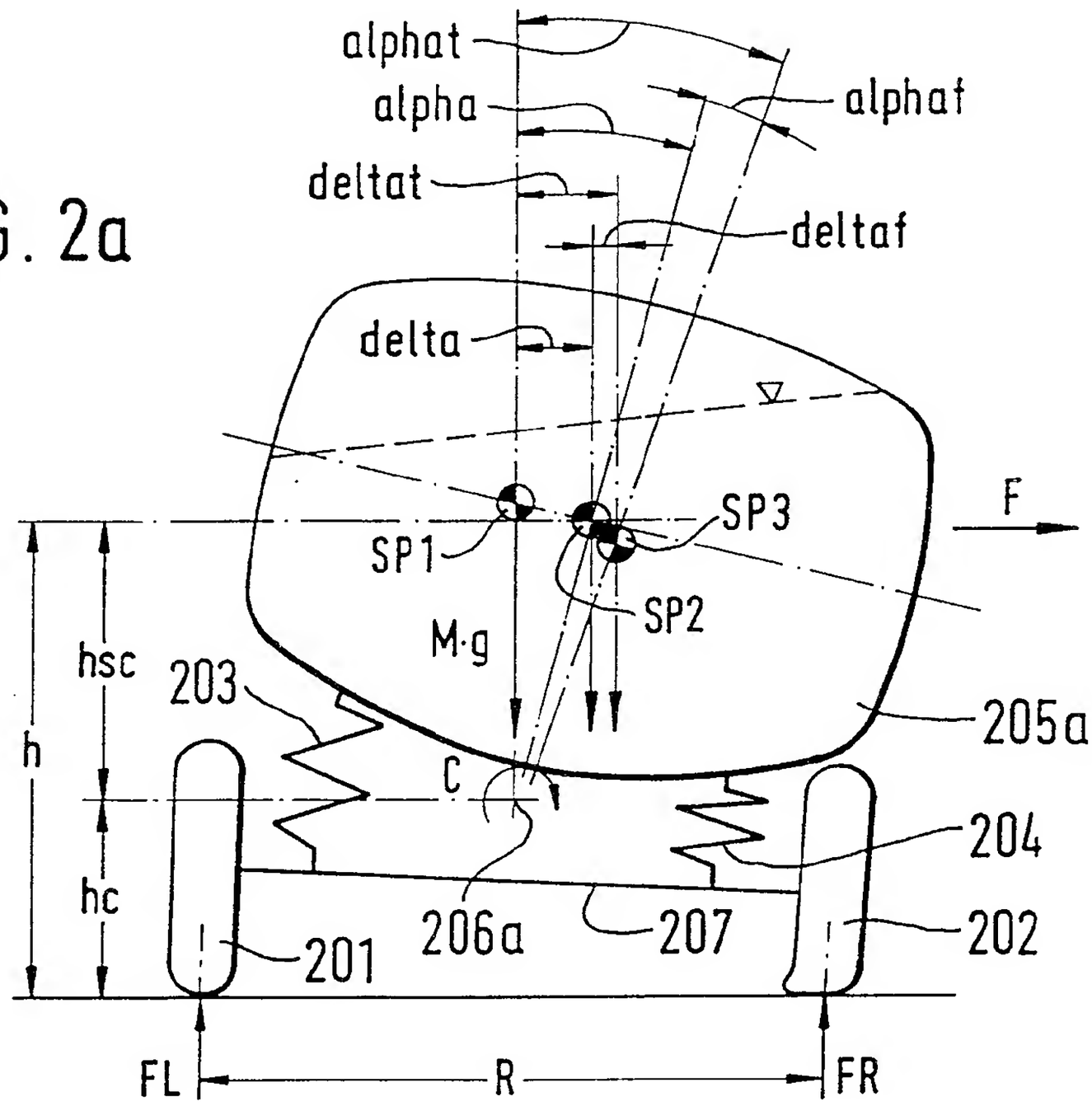
FIG. 2a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alphat
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delta
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SP3
SP2
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hc
206a
207
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201
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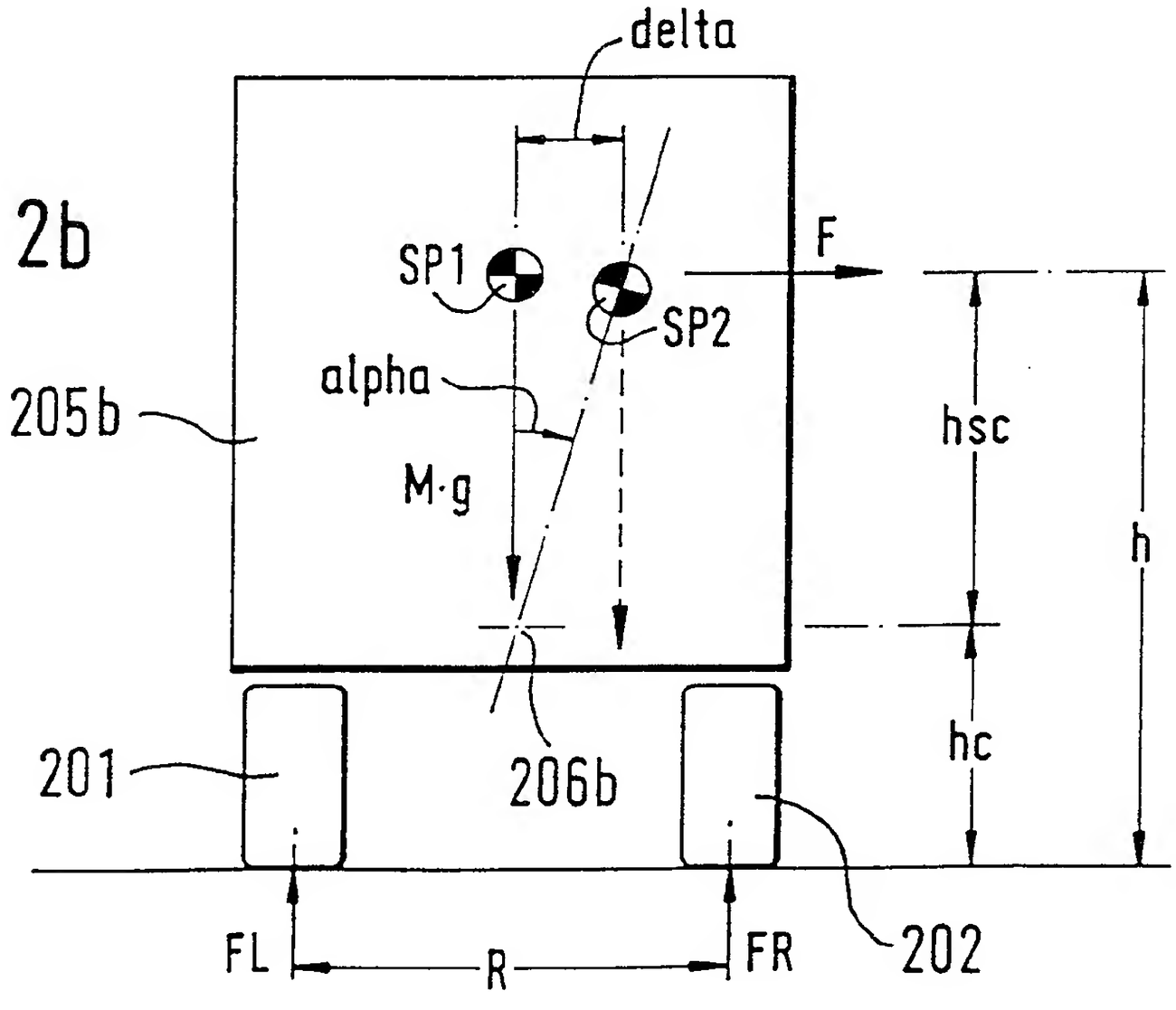
R
FR

FIG. 2b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SP2
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h
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FIG. 2c

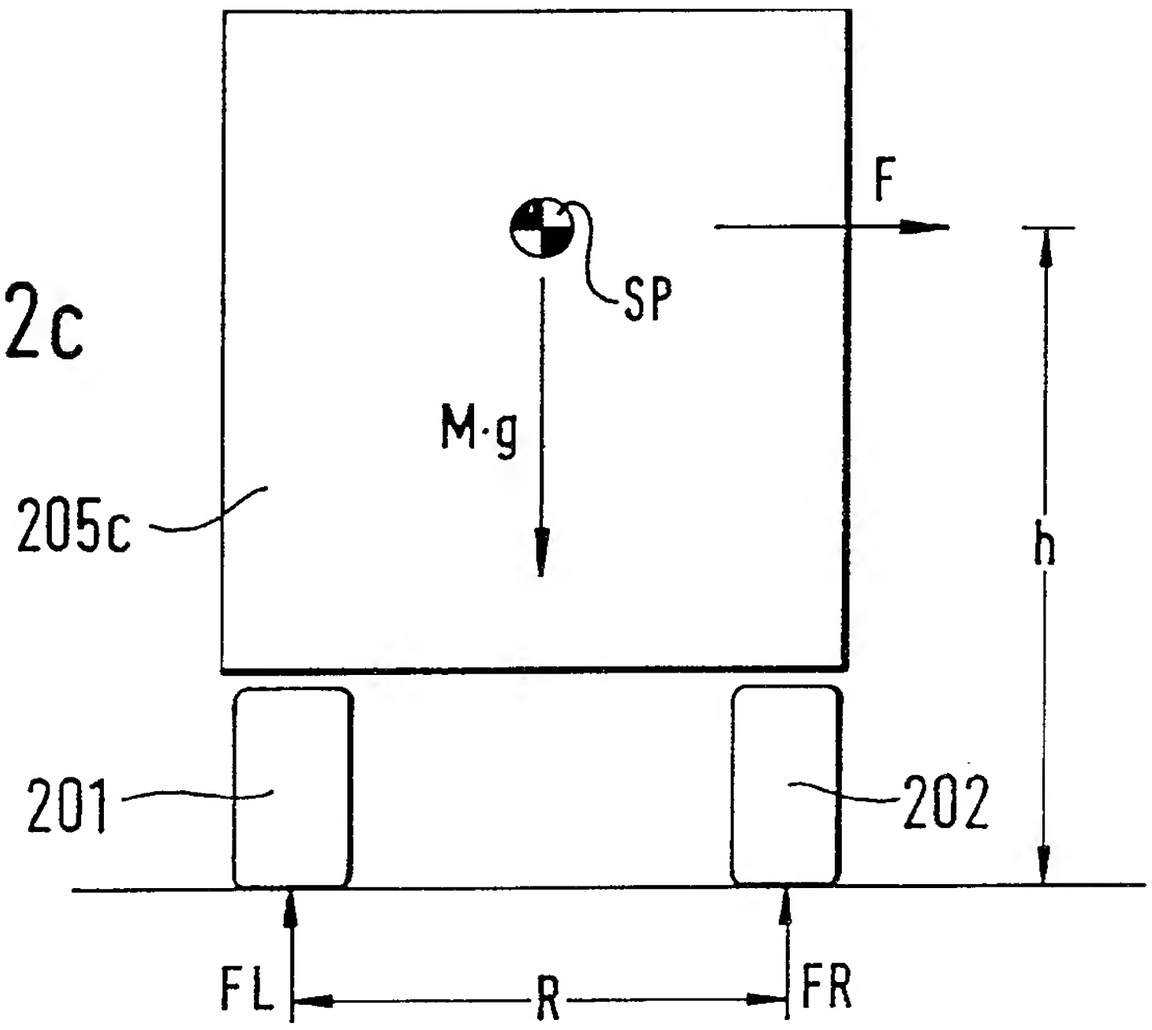
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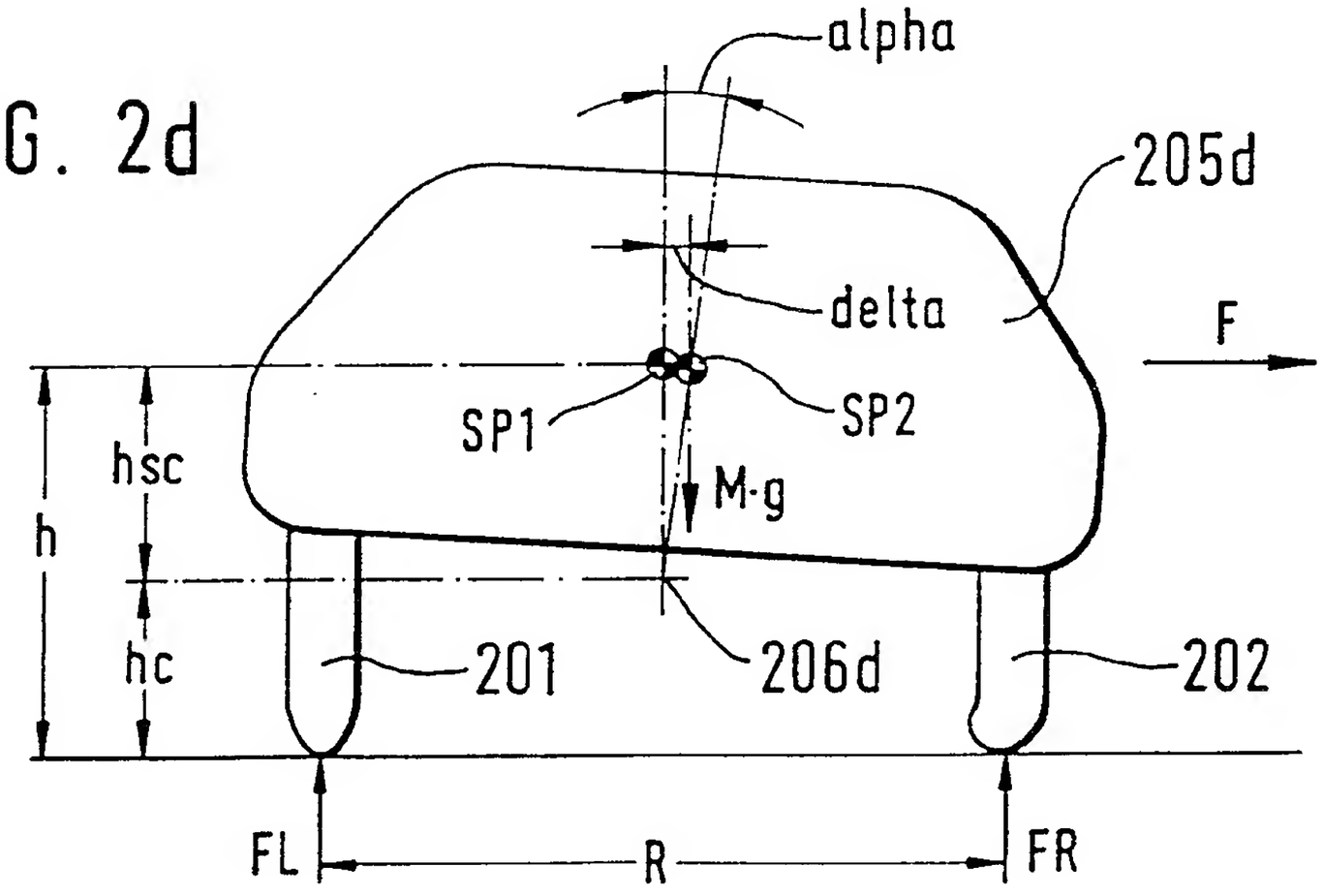
FIG. 2d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delta
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SP2
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h
hc
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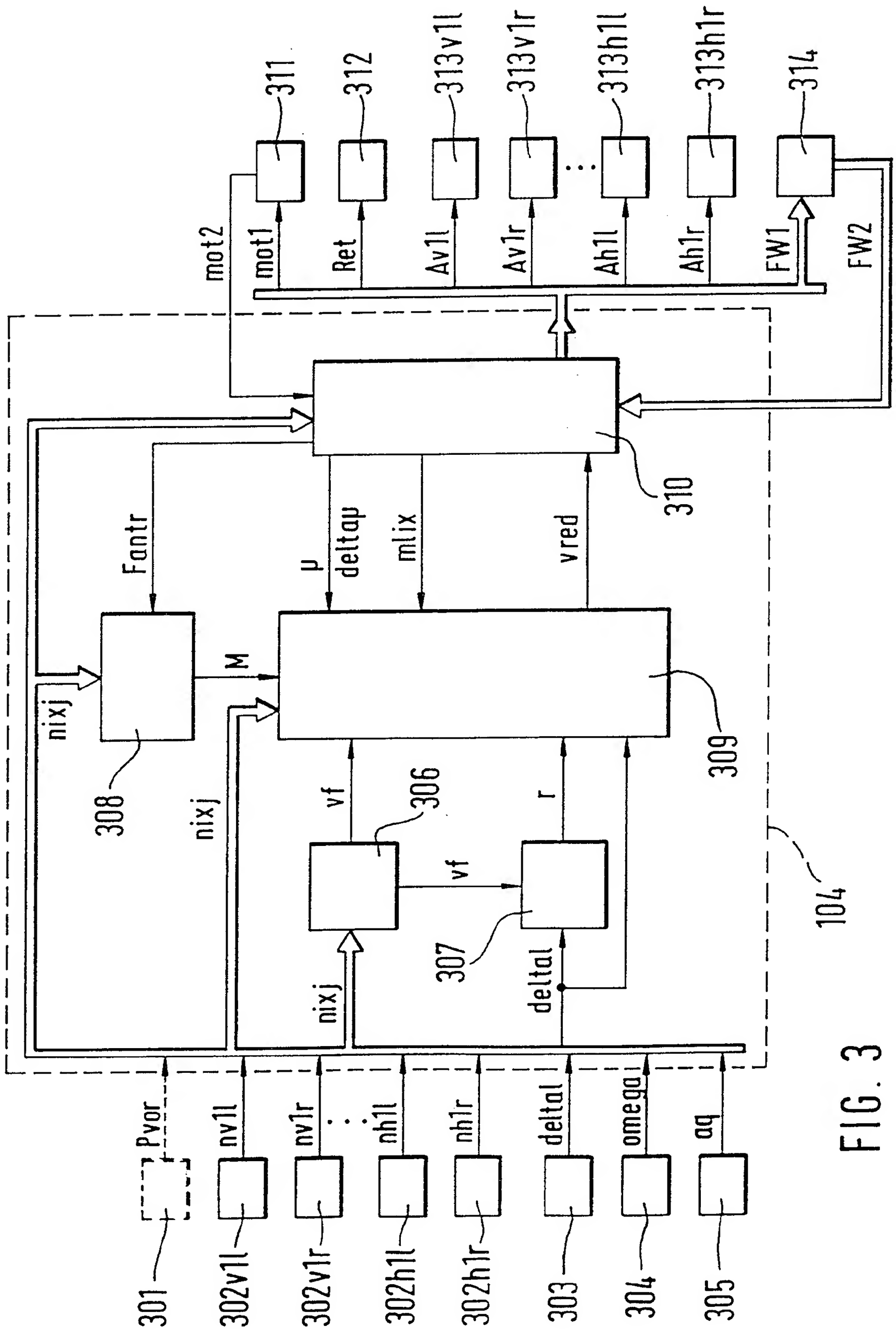
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313v1r
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mot1
Ret
Av1l
Av1r
Ah1l
Ah1r
FW1
FW2
310
Fantr
μ
deltaμ
mlix
vred
M
nixj
308
309
vf
306
r
307
deltal
104
Pvor
nv1l
nv1r
nh1l
nh1r
deltal
omega
aq
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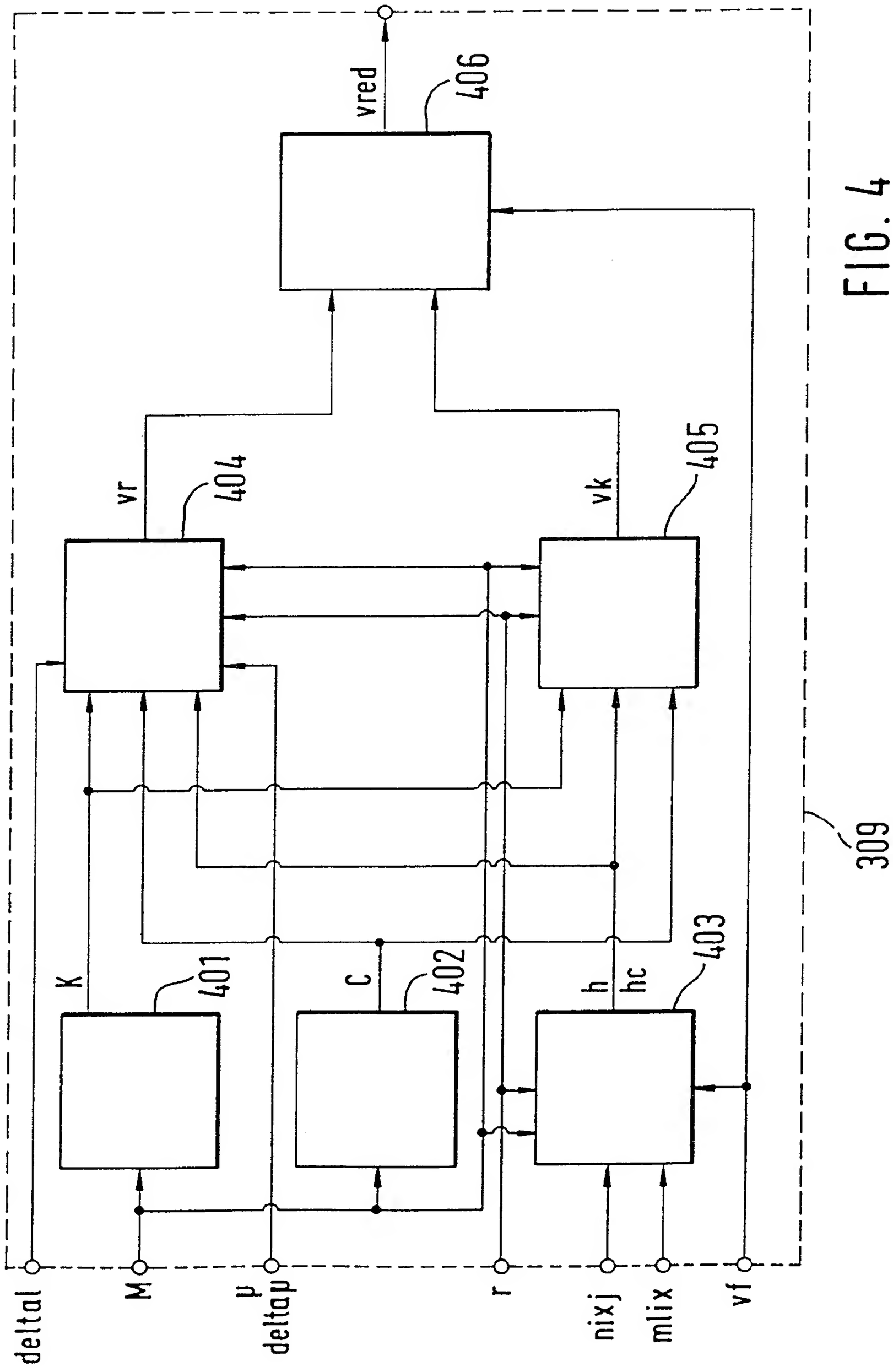
302v1r
302h1l
302h1r
303
304
305

FIG. 3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vr
404
vk
405
K
401
C
402
h
hc
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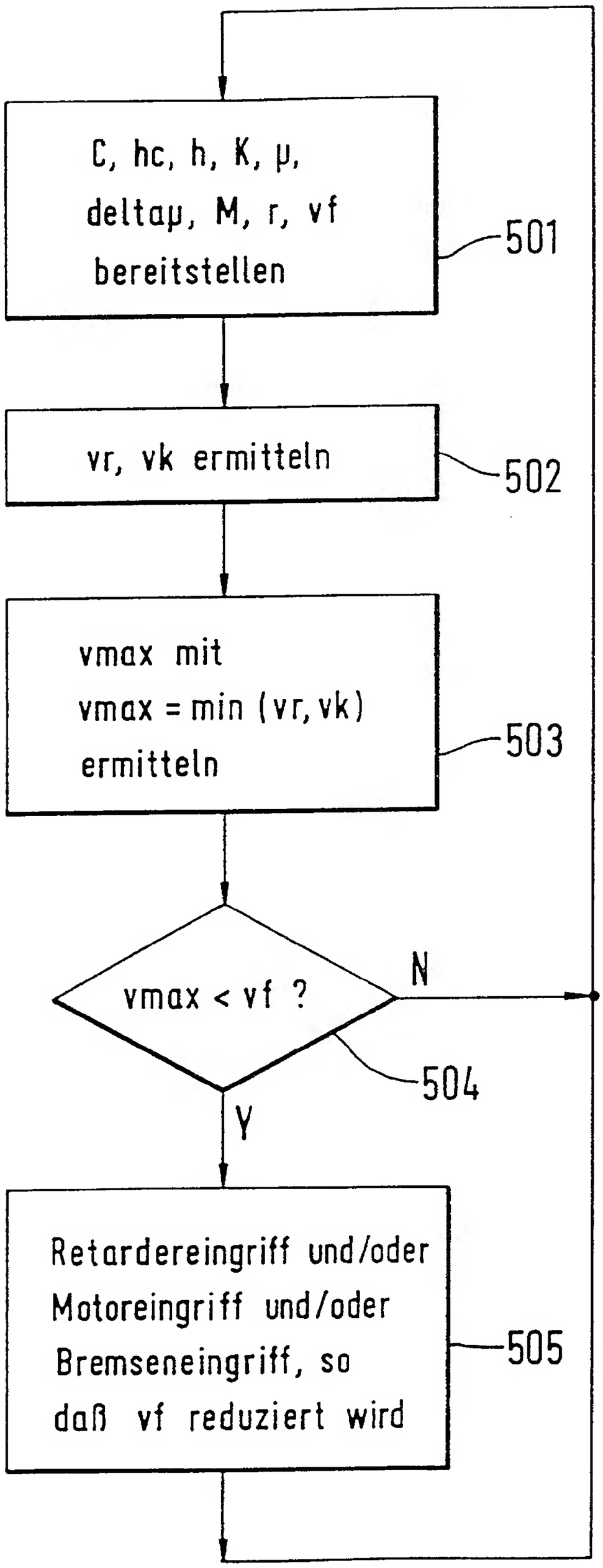
309
deltal
M
μ
deltaμ
r
nixj
mlix
vf

FIG. 4

FIG. 5


C, hc, h, K, μ,
deltaμ, M, r, vf
bereitstellen
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vr, vk ermitteln
502
vmax mit
vmax = min (vr, vk)
ermitteln
503
vmax < vf ?
N
504
Y
Retardereingriff und/oder
Motoreingriff und/oder
Bremseneingriff, so
daß vf reduziert wird
505